



SANITARY SEWER SYSTEM CONSTRUCTION SPECIFICATIONS
Revised 08/01/03

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PRE-CONSTRUCTION MEETING/INSPECTIONS

1.0 SCOPE

This specification covers the material requirements and installation procedures for all sanitary sewer pipe, structures and appurtenances to be accepted into the City of Carrollton sewer system. Any sewer pipe, structures or appurtenances which the City has reason to believe are not in conformance with these specifications will not be accepted.

2.0 GENERAL

The contract drawings approved by the City indicate the extent and general arrangement of the sanitary sewer system. If any departure from the approved contract drawings is deemed necessary by the contractor, details of such departures and the reasons therefore shall be substituted to the City as soon as possible for approval. No such departures shall be made without the City's written approval.

All approved sewer system plans and these specifications shall be considered as supplementary, one to the other, so that materials and labor indicated, called for, or implied by these specifications and not on the plans shall be supplied and installed as though specifically called for on the plans.

No utility system shall be constructed, erected, altered, or repaired unless a certified utility manager or certified utility foreman who holds a current certification is present at the job site of such construction, erection, alteration, or repair of the utility system. Proof of such certification shall be provided to the City prior to the commencement of any utility work.

All contractors should be aware of the City's construction specification requirements prior to construction. Sanitary sewer as-builts including tap locations shall be submitted to the Public Utilities Administrator prior to final approval.

3.0 QUALITY ASSURANCE

Acceptance of all sewer pipe, structures and appurtenances shall be on the basis of the City's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with all applicable standards.

Each pipe shall be clearly marked as required by the governing ASTM Standard Specifications to show its class, date of manufacture and the name and trademark of the manufacturer. Latitudes in workmanship and finish allowed by the ASTM Specifications notwithstanding all pipe shall be first quality, have smooth exterior and interior surfaces, and be free from cracks, blisters, and other imperfections, and true to theoretical shapes and forms throughout each length. All pipe shall be subject to inspection by the City at the pipe

plant, trench and other points of delivery for the purpose of accepting or rejecting pipe, independent of laboratory tests, which does not conform the requirements of this Section. Pipe, which does not conform, shall be marked as such by the City and shall not be delivered or used in the work. On-the-job repairing of rejected pipe will not be permitted. Any pipe or special items which have been broken, cracked or otherwise damaged before or after delivery or which have failed to meet the required tests shall be removed from the site of the work and shall not be used therein.

4.0 PIPE MATERIALS

4.1 Polyvinyl Chloride Gravity Sewer Pipe (six-inch diameter through 18-inch diameter):

- A. Pipe:** PVC gravity sewer pipe shall be SDR 35 manufactured in accordance with ASTM D 3034 November 1985 or latest revision, and supplied in lengths of approximately 13-feet.
- B. JOINTS:** Joints for pipe and fittings shall be of the bell and spigot type with a confined elastomeric gasket having the capability of absorbing expansion and contraction without leakage. The joint system shall be identical for pipe and fittings and performed in strict conformance with ASTM D 3212 and ASTM F 477.
- C. FITTINGS:** Fittings for pipe shall be one piece with no solvent-welded joints. No field fabrication of fittings will be allowed. All such fabrication shall be performed at the factory and the fittings delivered ready for use.
- D. TESTING:** Material acceptance will be on the basis of the City's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with all applicable ASTM standards, latest revisions.

4.2 Ductile Iron Pipe (six-inch diameter through 48-inch diameter):

- A.** Ductile iron pipe shall conform to AWWA C151 and shall be a minimum of class 50 or greater if specified by the designing engineer. All ductile iron pipe shall have cement mortar lining. Cement mortar lines ductile iron pipe may be acceptable at the City's discretion in limited situations. The City will determine the polyethylene lining for pipe and fittings. Fittings shall conform to AWWA C110 with a rated working pressure of 150 PSI. Pipe and fittings shall be furnished with a bituminous outside coating. All pipe with less than three-feet of cover shall be ductile iron pipe.
- B. Joints:** Pipe shall have push-on joints. All non-restrained fittings shall mechanical joint be joint type. Joints shall conform to AWWA C111. Restrained joint pipe and restrained joint fitting shall be either the bolted joint type or modified push-on joint type with joint restraint using ductile iron components. Restrained joint pipe on piers shall have bolted joints and shall be specifically designed for clear spans of at least 18-feet. Ductile iron pipe must be approved by the City prior to installation and must meet AWWA Standards.

- C. **Testing:** Acceptance of the material will be based upon the City's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with all applicable standards.

4.3 Reinforced Concrete Pipe (24-inch diameter or greater unless approved by the City):

- A. **Pipe:** Pipe shall be reinforced concrete bell and spigot with type two cement and calcareous aggregate conforming to ASTM C 76 for Wall C pipe. Pipe shall be supplied in lengths of at least eight feet.
- B. **Joint:** Pipe shall have rubber gasket type joints with steel and rings conforming to ASTM C 443. A rectangular groove shall be supplied in the spigot end to receive the rubber gasket, and it shall be so formed to a rectangular shape and confined on all four sides. Bell and spigot surfaces shall be accurately formed and smooth to provide a close sliding fit with a nominal clearance of 1/16-inch.
- B. **Testing Requirements:** Concrete pipe with a diameter of 60-inches or greater shall undergo a certified material test and inspection of manufactured pipe for defects and imperfections defined in paragraph 4.1.2. of ASTM C 76. Concrete pipe with a diameter between 30 inches and 60 inches shall be in addition undergo plant load bearing testing. Test results on pipe, joint material, and made-up joints must be performed by an independent testing laboratory approved by the City. Results to be supplied shall include materials, absorption, crushing (where applicable), and hydrostatic leakage on pipe each size in accordance with applicable specifications.
- D. **Lining:** The reinforced concrete pipe shall be epoxy lined.
- E. **Contractor Inspection:** The contractor shall inspect pipe after delivery for laboratory stamp, shape, cracks, uniformity, blisters and imperfect surfaces, hammer test, damaged ends, and gasket grooves. The contractor will not accept or use repaired or patched pipe or pipe with repaired or patched gasket grooves or shoulders.

5.0 EXCAVATION

The contractor is to perform all excavation of every description and of whatever substance encountered to the depth shown on the approved construction drawings for all sewers, manholes, piers, conduits, and other appurtenances. All excavation is to be performed in strict conformance with the Occupational Safety and Health Act of 1970 (PL 91-596) or latest applicable revision. Contractor is responsible for acquiring all applicable city and county permits.

Excavation shall be accomplished by open cut, unless otherwise directed. No tunneling shall be done, except as approved by the City or the Georgia Department of Transportation.

It is the responsibility of the contractor to ascertain all permits by all governing agencies prior to installing any sewer pipe or appurtenances beneath their roadway pavement.

5.1 TRENCH DIMENSIONS:

The top portion of the sewer pipe trenches may have sloping or vertical sides to widths, which will not cause damage to adjoining structures, roadways, pavements, utilities, and private property. For untimbered trenches and trenches held by stay bracing only, the width of the lower portion of the trench to a height of two-feet shall be specified in the "Maximum Trench Widths and Depths" Section 6.5. Where skeleton and solid sheeting is used, trench width may be increased to dimensions approved by the city, but shall not be greater than that necessary to clear the walls when lowering pipes into the trench. Where in the opinion of the City trench excavation may damage adjoining poles, roadways, utilities, and private property, the City may order suitable sheeting to be installed for their protection. Such orders shall in no way relieve the contractor from that responsibility of protection of these facilities, nor shall the lack of those orders relieve the contractor from that responsibility. If trenches are excavated to widths in excess of the above limitations, or collapse because of insufficient bracing and sheeting, the developer will be required to use special methods of constructing pipe foundations and backfilling as specified herein. All construction must meet or exceed OSHA Standards. Trench excavation shall not advance more than 600 feet ahead of pipe laying, unless approved. The bottom of all trenches shall be smooth and flat and with backfill material affording full bearing of the pipe barrel. The depth and width required shall be directed by the City.

Excavation in excess of the depth required for proper trenching shall be corrected by one of the special methods specified herein, as ordered by the city. Bell holes shall be excavated in a manner which will receive pipe bells of all load, and ensure support is provided throughout the length of the pipe barrel. Excavation in excess of the depths required for manholes and other structures shall be corrected by placing a sub-foundation of Class "C" concrete.

If trenches are excavated to excessive dimensions or collapse because of inadequate or Improperly placed bracing and sheeting, the pipe shall be laid using the next class of bedding. If over excavation for manholes and other structures occurs, the area under the structure or manhole shall be backfilled with granular bedding material to the required grade.

5.2 Bracing and Sheeting:

The contractor shall provide bracing and sheeting when required by regulations or to prevent damage to adjoining structures, roadways, and pavements, utilities, trees, or private property which are specifically required to remain.

- A. Timber:** Timber for shoring, sheeting, or bracing shall be sound and free of large or loose knots and in good condition. Size and spacing shall be in accordance with OSHA regulations.

Remove bracing and sheeting in units when backfill reaches the point necessary to protect the pipe and adjacent property. Leave sheeting in place when in the opinion of the City it cannot be safely removed. Cut off sheeting

left in place at least two feet below the surface.

B. Steel Sheet Piling: Continuous lockjoint steel sheet piling may be substituted for timber sheeting when approved by the City. Steel piling may removed, without cutting, provided the rate of removal is kept in pace with the tamping and backfilling operations to assure complete filling of the void created by the withdrawal of the piling. Complete withdrawal of the piling in advance of the tamping and backfilling will not be permitted. Piling, where directed to be left in place by the City for reasons of safety, will be cut off where directed.

5.3 Dewatering Trenches: Trenches requiring dewatering shall be dewatered continuously to maintain a water level below the bottom of the trench. Dewatering running sand shall be accomplished by well pointing. Where soil conditions do not permit use of well pointing, construct trench drains of crushed stone or gravel to conduct water to sumps. Any problems from the dewatering process shall be the responsibility of the contractor. Dewatering wells must be removed and all voids filled when the job is completed.

5.4 Trench Stabilization: Wheresoever the subgrade is by nature too soft and mucky in the opinion of the City for the proper installation of the sewer, the City may order the contractor to undercut the ditch and backfill with crushed stone or gravel not larger than $\frac{3}{4}$ inch in size. The stone shall be brought to grade and compacted.

6.0 ROCK EXCAVATION

6.1 Definition of Rock: Any material, which cannot be excavated with a backhoe, having a bucket curling force rated at not less than 18,300 pounds (Caterpillar Model 215 or equal) and occupying an original volume of at least $\frac{1}{2}$ cubic yard.

6.2 Excavation: Where rock is encountered in trenches, it shall be excavated to the minimum depth which will provide eight inches or more clearance below the pipe barrel and manhole. Remove boulders and stones to provide a minimum of six inches clearance between the rock and any part of the pipe or manhole.

6.3 Blasting: The contractor shall provide only experienced workmen to perform blasting. All blasting operations shall be conducted in accordance with all existing ordinances and regulations. All structures shall be protected from the effects of the blast. The contractor shall be responsible for requiring any resulting damage. If the contractor persistently uses excessive blasting charges or blasts in an unsafe or improper manner, the City may direct the contractor to employ an independent blasting consultant to supervise the preparation for each blast and approve the quantity of each charge. The contractor blasting shall be insured.

6.4 Removal of Rock: Excavated rock shall not be used as backfill material. Rock which is surplus or not suitable for use as rip-rap shall be disposed of.

6.5 Maximum and Minimum Trench Widths: Trench widths for each pipe installation will be dictated by the soil conditions encountered. Trench width for all pipe materials shall be kept

to nine inches minimum and 12 inches maximum on both sides of the outside diameter of the pipe.

7.0 BEDDING-FLEXIBLE CONDUIT

7.1 The following bedding materials and installation requirements shall be followed for polyvinyl chloride pipe being installed.

- A. Trench Preparation:** The bottom of the trench shall be flat and excavated to the minimum depth below the bottom of the pipe barrel as shown on the drawing.
- B. Bedding Placement and Compaction:** The contractor shall place and compact the bedding material to the proper grade. The bedding material shall be carefully placed by hand and hand tamped to provide full support under the pipe and to the top of the pipe. The contractor shall be cautious when tamping so no voids will be present in the backfill in the haunch area of the pipe. No compaction of the backfill other than hand tamping will be allowed until the backfill above the pipe reaches two feet above the top of the pipe.
- C. Bedding Material:** Crushed stone bedding shall meet the requirements of ASTM C 33 No. 57, No. 6 or No. 67 stone.

8.0 BEDDING – RIGID CONDUITS

8.1 Class of Bedding for Various Depths of Installation of Reinforced Concrete Pipe:

Bedding for reinforced concrete pipe shall be in accordance with ASTM C 12 Bedding standards with the depths of installation shown on the approved drawings and in accordance with Table I hereinafter.

- 8.2 Bedding for ductile Iron Pipe:** The contractor shall excavate the trench to $\frac{1}{4}$ the normal pipe diameter below the depth shown on the approved plans. Bedding material shall be placed and compacted by the contractor to the proper grade. Bedding shall then be carefully placed and compacted to provide full support under and up to the center line of the pipe.
- 8.3 Bedding Material:** In most instances, clean native soil meeting the Class I material requirements may be used for bedding of Ductile Iron Pipe. Crushed stone bedding material shall meet the requirements of ASTM C 33 No. 57, No. 6, or No. 67 stone.

TABLE 1

**TRENCH WIDTHS AND DEPTHS IN FEET FOR REINFORCED
CONCRETE PIPE, WITH VARIOUS BEDDING METHODS**

Maximum Trench Width	Class of Pipe	Depth of Pipe (Feet) Class of Bedding		
		C	B	A
4' - 7"	3	13	16	30
4' - 7"	4	20	28	30
4' - 7"	5	30	30	30
5' - 5"	3	13	16	28
5' - 5"	4	20	28	30
5' - 5"	5	30	30	30
6' - 1"	3	14	18	30
6' - 1"	4	22	28	30
6' - 1"	5	30	30	00
6' - 9"	3	14	17	29
6' - 9"	4	22	27	30
6' - 9"	5	30	30	30
7' - 6"	3	15	18	26
7' - 6"	4	20	24	30
7' - 6"	5	30	30	30
8' - 3"	3	16	18	28
8' - 3"	4	22	27	30
8' - 3"	5	30	30	30
9' - 0"	3	16	18	28
9' - 0"	4	22	27	30
9' - 0"	5	30	30	30
9' - 9"	3	16	18	28
9' - 9"	4	22	27	30
9' - 9"	5	30	30	30

8.4 Bell Holes: Bell Holes shall be provided in all classes of bedding so as to relieve pipe of all load. Bell holes are not required for clay plain-end pipe.

8.5 Increase in Bedding Classes: The determination of the bedding class shall be from the actual width of the trench. If the contractor increases the width of the trench for his convenience or due to collapse of trench walls so that a higher class of bedding is required, the increase cost of same shall be borne by the contractor. If the bearing value of the subgrade is determined by the contractor or the City to be inadequate for a particular class of bedding, the contractor shall substitute a higher class bedding. In inundated area, the contractor shall add the necessary granular bedding material to stabilize the pipe trench as determined by the City.

9.0 BACKFILLING

The contractor shall backfill all trenches fully to restore the ground surface to its original condition. The contractor shall dispose of all surplus material. Backfill material cannot contain any rock larger than six inches square or any trees, stumps, or limbs. The right-of-way shall be sloped with contour of the land so that the right-of-way does not act as a ditch for water run off.

- 9.1 Suitable Backfill Material:** Suitable backfill material is earth material excavated from the trench which is clean and free of rock, organic, and other unsuitable material. The contractor should use extreme care when selecting the initial back-fill material to be placed to a depth of 12 inches over the top of the pipe. This initial backfill material should be free of all rock, and clods which could damage the pipe in any way. If the backfill material excavated from the trench is not suitable for use as initial backfill material, the contractor will obtain suitable materials elsewhere.
- 9.2 Procedures for Backfilling:** The contractor shall place the initial backfill material carefully around the pipe or over the bedding material covering PVC or ductile iron pipe in uniform six-inch layers to a depth of at least 24 inches above the pipe bell. Each layer shall be compacted thoroughly without disturbing or damaging the pipe. Caution should be taken when compacting backfill material above polyvinyl chloride pipe. The backfill material over PVC pipe should be compacted by hand tamping until a depth of two feet above the top of the pipe is reached. The contractor shall backfill on both sides of all types of pipe simultaneously to prevent side pressure.
- 9.3 Compaction Methods for Fill More Than Two Feet Above the Pipe:** The contractor shall compact the backfill in six-inch layers if using light power tamping equipment, such as a "jumping jack." The contractor shall compact the backfill in two-foot layers if using heavy tamping equipment, such as a hammer with tamping feet.
- 9.4 Backfill Under Roads:** Backfill to be placed under roads shall be compacted to 95% Standard Proctor Density per ASTM D 698 or as required by all local governmental agencies that have jurisdiction over the road.
- 9.5 Settlement:** If trenches settle, the contractor shall refill and grade the surface to conform to the adjacent surfaces.
- 9.6 Surfacing of Trenches in Dirt Streets and Driveways:** Where trenches are along dirt streets and across dirt driveways open to vehicular traffic, the remaining 12 inches of backfill up to the traveled surface shall be made with crusher run stone, compacted and maintained until the pavement is replaced.
- 9.7 Surfacing of Trenches in Paved Streets and Driveways:** Where trenches are in paved streets and driveways, the remaining 12 inches of backfill up to the traveled surface shall be made with crusher run stone, compacted and maintained until the pavement is replaced.

- 9.8 Additional Material:** Where final grades above the pre-existing grades are required to maintain minimum cover, the contractor is to supply additional fill material to meet the final grade requirements shown on the drawings. The contractor may utilize excess material excavated from the trench if the material is suitable. If the excess excavated materials are not suitable, or if the quantity available is not sufficient, the contractor shall provide additional fill material.

10.0 MANHOLES

- 10.1 Acceptable manhole Materials:** Manholes shall be precast per applicable ASTM C 478 standards. Manholes shall be eccentric. Manholes shall have copolymer coated plastic steps on centers between 12 and 16 inches for all manholes over two feet in depth. All manholes shall have flexible boot seals where the sewer pipes enter and leave the manhole. All flexible rubber boot seals shall be jointed to the manhole at the manufacturing plant. Holes for pipe entering or leaving the manhole shall be core drilled to a minimum of six inches above the base floor of the manhole at the plant or in the field and a rubber boot installed. Manholes shall use mastic seat at the joints and shall be grouted inside and outside.

- 10.2 Manhole Trench Excavation:** Manhole trenches shall be excavated to a minimum of 12 inches below the planned elevation of the base of the manhole. The contractor shall place and compact 12 inches of stone bedding material as a manhole foundation and set the bottom of the manhole to the required grade shown on the approved plans before constructing the manhole.

- 10.3 Bedding Material:** All bedding material shall be crushed stone, unless shown or specified otherwise. Crushed stone bedding material shall meet the requirements of ASTM C 33 No. 57 and No. 67 stones.

- 10.3 Backfilling Around Manholes:** Excavated material may be used for backfilling manholes above bedding if suitable and approved by the City. Backfill shall be placed in six-inch layers and compacted to 95% modified proctor per ASTM standards.

- 10.5 Inverts:** Manhole inverts shall be precast as per Section 10.1 Standards.

Invert Formation: Invert channels shall be properly formed, rounded, and troweled smooth. Inverts shall be formed to the top of the pipe at the back of the table and $\frac{3}{4}$ of the pipe at the channel. The bench shall have a 2-inch in 12-inch slope. Special care shall be taken to lay the channel and adjacent pipes to grade. The inverts shall have a cross section of the exact shape of the pipes which it connects. Changes in size and grade shall be made gradually and evenly. Changes in the direction of the sewer and entering branch or branches shall have a true curve of a radius as large as the size of the manhole will permit. The connections of the sewer with the wall and channel of the manhole shall be tight and smooth. When brick filler material is used in the construction, the depth of grout above the brick work shall be at least two inches thick.

- 10.6 Top Elevations:** All manholes outside paved areas shall be built to have top elevations

shown on the plans or directed by the City. Manholes in paved areas shall be built to top elevations even with the existing grade. Adjustments of ring and covers for street resurfacing shall be accomplished utilizing an adjustment ring allowing vertical adjustments beginning with $\frac{3}{4}$ inch minimum and increasing at $\frac{1}{4}$ inch intervals up to 2 inches of height. Adjustment rings shall be "clear-span manhole and adjusting ring" (manufactured by Cretex Specialty Products) or equal. Ring and cover adjustments in general shall not be greater than 18 inches unless approved by the City.

10.7 Drop Connections: Drop connections will be required, where called for on the drawings. Drop pipes shall be the same size as the sewer which they serve. Openings in walls of Pre-cast concrete manholes for drop connections shall not be made at joints. Drop connection fittings and riser pipes of PVC shall be encased in Class "C" concrete. Drop connections for precast concrete manholes shall conform with the typical details for manholes shown in the Appendix. Drop connections shall be carefully backfilled to prevent dangerous side pressures.

10.8 Casting: Manhole rings and covers shall be per the City's standard drawings shown in the Appendix. Covers shall be either the non-traffic, traffic, or bolt-down watertight type. Traffic type manhole covers will be used when the manhole is to be placed in pavement and/or will be subjected to vehicular loadings. Bolt-down watertight manhole covers will be used on all manholes to be placed in flood plain areas and other areas as determined by the City.

10.9 Future Sewer Connections: Where shown on the drawings, a 12-foot long pipe stub for future sewer connections shall be laid on proper grade and alignment and plugged with a factory plug with the same type joint as used on the sewer pipe. The location of the end of the stub is to be flagged in the field by the contractor and indicated on the as-built drawings to be supplied to the City by the developer.

11.0 FORCE MAINS:

All force mains shall be polyethylene lined ductile iron pipe per AWWA standard C151. Class of pipe shall be as required for working pressure plus surge pressure and as directed by the City. All fittings shall be mechanical joint per AWWA standards. Force main fittings shall be installed per AWWA standards. Pipe fittings shall be polyethylene lined. The lining shall be 40 mils and in conformance with ASTM D 1248. All bends, tees and crosses shall be blocked. Air release valves should be installed in all high points and other areas as required.

12.0 LATERAL SEWERS

12.1 Installation Requirements: The contractor shall install wyes or tees in the locations shown on the plans for connection of existing or future service lines. The contractor shall install service lines with proper grades and alignment to the property line where shown on the drawings or otherwise required. Service lines for future service shall be plugged using Etco Stoppers or equal at the right-of-way line using the stopper of the appropriate size. All laterals shall extend from the sewer line to edge of the property line. All sewer laterals shall be tapped into any sewer trunk line using the appropriate tapping machine. Dry sewer

laterals shall have permanently glued caps.

- 12.2 Material, Bedding and Backfilling Requirements:** Laterals shall be installed using polyvinyl chloride pipe or ductile iron pipe in accordance with the material requirements based on depth of cover. Laterals and sewer mains are to be bedded and backfilled in accordance with bedding requirements as shown on the plans and in the Appendix of these specifications.
- 12.3 Cleanout:** Service lines with cleanouts must have a bronze top with a bronze cap when installed in parking areas. All cleanouts must be kept at surface level or lower (preferably buried).

13.0 PIPE LAYING

- 13.1 Clearing:** The contractor shall clear the permanent easement before excavating. The contractor shall remove from the site all trees, growth, debris, stumps, and other objectionable matter. The construction easement should only be cleared if necessary.
- 13.2 Location and Grade:** The drawings shall show the alignment and grade of the sewer and the position of the manholes and other appurtenances. The grade line shown on the sewer profile and called for on the plans shall be the grade of the invert of the pipe. The contractor shall use laser equipment to establish the pipe alignment and grade required on the plans. The pipe shall be laid so that the pipe bells are upstream to the direction of the sewerage flow.

14.0 CONSTRUCTION ALONG HIGHWAYS, STREETS AND ROADWAYS

- 14.1 Conformance with Governmental Agencies:** The contractor shall comply with all construction operation requirements, safety requirements, traffic control requirements, road maintenance requirements and repair requirements of the City of Carrollton and/or the Georgia Department of Transportation while installing any sewer line and/or appurtenance along highways, streets and roadways. Contractor must obtain permits from the City, the County and/or the State before construction begins.
- 14.2 Protection of Traffic:** The contractor is to provide and maintain suitable signs, barricades, and lights for protection of traffic. All highway signs removed for construction shall be replaced as soon as possible. The contractor shall not close or block any highway, street or roadway without first obtaining permission from the proper authorities. Experienced flagmen shall be provided to direct and expedite the flow of traffic.
- 14.3 Construction Operations:** The contractor is to perform all work along highways, streets and roadways to minimize traffic interference.
- A. Stripping:** Where the pipeline is laid along road shoulders, the contractor shall strip and stockpile all sod, topsoil, and other material suitable for shoulder restoration.
- B. Trenching, Laying, and Backfilling:** Trench excavation shall not be open cut any

further ahead of pipe laying operations than is necessary. The contractor shall backfill and remove excess material immediately behind laying operations. All lines shall be plugged at the end of each day.

- C. **Shaping:** The contractor shall reshape damaged slopes, side ditches and ditch lines immediately after completing backfilling operations. Topsoil, sod, and any other materials removed from shoulders shall be replaced.

- 14.4 **Excavated Materials:** The contractor shall not replace excavated material along highways, streets, and roadways in a manner which obstructs traffic. All scattered excavated material shall be swept off the pavement. If all material cannot be removed from the pavement, the contractor is to notify the governmental agency having jurisdiction over the street or roadway so that they may assist the contractor in clean up efforts. The contractor shall be responsible for any fees or damage resulting from his construction activity.

15.0 REMOVING AND REPLACING PAVEMENT

- 15.1 **Removing Pavement:** The contractor shall remove existing pavement as necessary for installing the pipe line and appurtenance.

- A. **Marking:** Before removing any pavement, the contractor shall mark the pavement neatly paralleling the pipe line and existing street lines. The marks shall be spaced the width of the trench.
- B. **Breaking:** The contractor shall break the asphalt pavement along the marks using jack hammers or by scoring with a rotary saw and breaking below the score by the use of jack hammers or other suitable tools.
- C. **Machine Pullings:** No pavement shall be pulled with machines until it is completely broken and separated from the pavement that is to remain.
- D. **Damage to Adjacent Pavement:** The contractor shall not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, the contractor is responsible for removing and replacing the damaged pavement.
- E. **Sidewalks:** Sidewalks shall be removed and replaced to their full width.
- F. **Curbs:** The contractor shall remove and replace or tunnel under any curb encountered.

- 15.2 **Replacing Pavement:** Upon completion of the placing and consolidation of the backfill, the contractor shall arrange to have the compaction tested by an independent testing laboratory approved by the City. This is per City/County requirements. After the compaction testing has been satisfactorily completed, the contractor shall replace all pavement, sidewalks and curbs that had to be removed.

15.3 Materials to be Replaced: The contractor shall place the materials for pavement replacement to the dimensions shown on the drawings. The following types of sub-bases shall be replaced:

- A. Graded Aggregate Sub-Base:** The contractor shall furnish graded aggregate sub-base size of such quantities that the resulting mixture is well-graded from coarse to fine and meets the graduation requirements of Section 816 of the State Highway of Georgia Department of Transportation Standard Specifications.
- B. Black Base:** The base for all paved roadways shall conform to the requirements of the Georgia State Highway Department of Transportation Specifications for the Black Base (Hot Mix). A pug mix rotary drum type mixer shall be used with a minimum capacity of not less than 50 tons per hour for asphalt production. The base shall be applied and compacted in two courses by asphalt spreader equipment of design and operation approved by the City. After compaction, the black base shall be smooth and true to establish profiles and sections.
- C. Surface Course:** The surface course for all pavement, including paint or tack coat then required by the governing agency, shall conform to the requirements of the Georgia State Highway Department of Transportation Specifications for Asphaltic Concrete, Section 400, Type "E" (Modified Top). The contractor shall produce the surface course in an asphalt plant of the same type as noted above for Black Base. The surface course shall be applied and compacted in a manner approved by the City. Any high, low or defective areas shall be immediately corrected by cutting out the course, replacing with fresh hot mix, and immediately compacting it to conform and thoroughly bond it to the surrounding area.
- D. Concrete:** The contractor shall provide concrete and reinforcing for concrete pavement on accordance with the requirements of the Georgia State Highway Department of Transportation Specifications for Portland Concrete Pavement.

15.4 Supervision and Approval of Pavement Restoration: Pavement restoration shall meet the requirements of the regulatory agency responsible for the pavement. The contractor shall obtain agency approval of all pavement restorations before requesting final payment. The contractor shall obtain the City's approval of restoration of pavement not the responsibility of a regulatory agency such as private roads and drives. The contractor shall complete the pavement restoration as soon as possible after backfilling.

- A. Replacement:** Prior to replacing pavement, the contractor shall make a final cut in Concrete pavement nine inches from the edge of the trench. The contractor shall make the cut using a rotary saw. Asphalt pavement shall be removed nine-inches back from the edge of the trench using jackhammers or other suitable tools. The contractor shall replace all street and roadway pavement as shown on the drawings. All driveways, sidewalks, and curbs shall be replaced with the same material and to the same dimensions as existed prior to construction.

- B. Failure of Pavement:** Should any pavement restoration or repairs fail or settle during construction or the warranty period, the contractor shall promptly restore or repair all defects.

16.0 BORING AND TUNNELING

The contractor shall furnish and install tunnel liner or pipe casing and install the pipeline therein in accordance with the following specifications:

- 16.1 Well Pointing:** The contractor shall operate well points or drainage systems in the vicinity of the tunnel or casing construction to prevent the accumulation of flood water in the tunnel or casing and to maintain the ground water table below the tunnel or casing invert.
- 16.2 Damage to Existing Structures:** The contractor shall take precautions to construct the tunnel so that no settlement of the overpassing roadway or railway section will occur. In order to prevent such settlement, the use of poling plates, breast boards, shields, and soil solidification or a combination of these methods may be necessary. The City shall not be responsible for any damage, which may result from the tunnel construction.
- 16.3 Boring:** The contractor shall furnish all materials and equipment and perform all labor required to install steel pipe casing at the locations indicated on the drawings. Boring design and materials shall be per all AERA, AASHTO, Georgia Dot, and other applicable standards.
- A. Material:** Steel-casing pipe shall be Schedule 30 steel pipe manufactured from steel conforming to ASTM A 139, Grade B. All casing size and thickness shall be as follows:

UNDER RAILROADS

Pipe Dam: Thick (inches)	Casing Inside Dam. (inches)	Wall (inches)
4	8	0.380
6	12	0.330
8	12	0.330
10	16	0.375
12	16	0.375
14	24	0.562
16	36	0.625
18	36	0.625
20	36	0.625
24	36	0.625
30	48	0.625

UNDER HIGHWAYS

Pipe Diam. (inches)	Casing Inside Diam. (inches)	Wall Thick (inches)
4	8	0.330
6	12	0.330
8	12	0.330
10	16	0.375
12	16	0.375
14	24	0.562
16	36	0.625
18	36	0.625
20	36	0.625
24	36	0.625
30	48	0.625

The steel sleeves shall be painted inside and outside with two coats of bitumastic paint prior to delivery on the job site.

- C. **Joint Usage of Casing Pipe:** The contractor shall not install any pipe in steel casing which already carrying a pipeline without the written approval of the City.
- D. **Installation of Casing Pipe:** The contractor shall install the steel casing pipe by the dry boring method. The contractor shall bore the hole and install the casing through the soil simultaneously by a cutting head on a continuous auger mounted inside the casing pipe to the preceding section in accordance with the AWS recommended procedures. After the boring and installation of the casing is complete, the contractor shall install a cleaning plug on the rig and clean the casing.
- E. **Rock Formations:** In the event that rock is encountered during the installation of the pipe casing which in the opinion of the City cannot be removed through the casing, the City shall direct the contractor to complete the crossing by installing a tunnel.

16.4 Tunneling: The contractor shall install the tunnel liner in strict accordance with the Department of Transportation (DOT) and / or Railroad Company requirements. The contractor shall provide any special insurance coverage required by the governing body. The tunnel installer shall have a minimum of five years of experience in the construction of tunnels of a similar size. The contractor shall submit evidence of the installer's experience for review by the City.

- A. **Blasting Permits:** Prior to any work involving explosives, the contractor shall make application to the DOT or other appropriate agencies for a blasting permit. This permit will be in addition to any tunneling permit not involving explosives. The contractor shall comply with all requirements and conditions of all permits including required submittals.

- B. Traffic Control Requirements:** The contractor shall schedule the work so as not to interfere with or in any way endanger traffic flow on the highway or railway. The contractor shall provide all required safety measures as specified in the Georgia Manual on Uniform Traffic Control Devices.
- C. Materials:** Tunnel Liner Plates shall be manufactured from steel conforming with ASTM A569 with the following mechanical properties before cold forming:

Minimum tensile strength – 42, 000 PSI
Minimum yield strength -- 28, 000 PSI
Elongation, two-inches -- 30%

Liner plates shall be 10 gauge, with the neutral axis diameter shown on the drawings for each crossing.

Minimum coatings required shall be galvanized in accordance with ASTM A 123 for liner plates and hot – dip galvanizing in accordance with ASTM A 307 for all other hardware. Additional protection required shall consist of a full bituminous coating meeting the requirements of AASHTO M 190. All plates shall be punched for bolting on both longitudinal and circumferential seams or joints and shall be so fabricated as to permit complete erection from the inside of the tunnel.

The plates shall be equipped with two inch standard pipe half-couplings welded into a hole in the center of the plate for grouting of voids occurring outside of the liner. Couplings shall be fitting with threaded cast-iron plugs. Bolts shall be no less than 5/8-inch diameter. Shop drawings showing details of the plates, size and length of bolts, and section modulus in inches curved per inch of width shall be furnished by the contractor for review by the engineer, the City and Georgia DOT.

- D. Tunnel Construction Methods:** After the tunnel has been completely constructed, the contractor shall thoroughly clean the interior and shall place structural quality concrete of a strength approved by the City within the invert of the tunnel. The contractor shall screen and trowel the top of the concrete to a smooth even surface at the exact level of the exterior of the pipe width placed to proper grade within the tunnel. As the pipe is jointed, it shall be drawn into position inside the tunnel.

Systems of standard pipe, fittings, hose and special grouting outlets embedded in the liner plates shall be provided by the contractor. Care shall be taken to ensure that all parts of the system are maintained free from dirt. Grout composed of cement, sand, and water shall be forced under pressure into the grouting connections. Grouting shall be started in the lower connections and shall proceed until grout begins to flow from upper connections. Connections shall then be made to these holes and the operation continued to completion.

Apparatus for mixing and placing grout shall be of a type approved by the design

engineer and the Georgia DOT and shall be capable of mixing effectively and stirring the grout and then forcing it into the grout connections in a continuous uninterrupted flow.

Liner plates shall be installed as soon as possible, but no more than five feet of tunnel shall remain unlined while tunneling operations are in progress. Not more than one foot of tunnel shall be left unlined at the end of the day's operation. The contractor shall locate the liner plates with grout couplings at the top of the tunnel at intervals not to exceed five feet. Additional plates with grout couplings shall be installed on each side of the tunnel between the top couplings.

After grouting is completed, pressure shall be maintained by means of stopcocks, or other suitable devices until the grout has set sufficiently. After the grout is set, grout holes shall be completely filled with dense concrete and finished neatly without evidence of voids or projections.

16.5 Installation of Pipe: After the installation of the casing or tunnel is complete, the contractor shall install the pipe line by a method which has received prior approval of the designing engineer and the City.

- A. Pipe Closure:** The contractor shall close the ends of the casing with four-inch brick walls, plastered with Portland Cement mortar. The contractor shall leave a drain opening at the bottom of the lower end.
- B. Tunneling Closure:** A brick bulkhead shall be constructed at both ends of the tunnel with a drain at the lower end. The bulkhead shall be a three course mortared brick wall, plastered with Portland Cement mortar and waterproofed with asphaltic roofing cement. Brick and mortar shall meet the requirements for manhole materials.

16.6 Safety During Boring: The contractor shall provide all necessary bracing, bulkheads, and Shields to ensure complete safety to all traffic at all times during the boring operation. All work shall be performed in such a manner as to not permanently damage the roadbed or interfere with normal traffic over it. If in the opinion of the City the installation is being conducted in an unsafe manner, the contractor will be required to stop work and bulkhead the heading until suitable agreements are reached between the contractor and the City. The City will not be responsible and shall be saved harmless in the event of delays to the contractor's work resulting from and cause whatsoever. All construction must meet or exceed OSHA requirements.

16.7 Safety During Tunneling: The contractor shall begin the tunneling operation in a pit, sheeted and shored as necessary and begin at and proceed from one end. The contractor shall observe all applicable requirements of all governing agencies and shall conduct the operations in such a manner that all work will be performed below the level of the roadbed. All work shall be coordinated and scheduled with all governing agencies. The contractor shall complete all tunneling work at one particular location before work is started at another location. All construction must meet or exceed OSHA requirements.

A temporary bulkhead against the face of the excavation shall be provided and placed during the cessation of work where the heading is within 20 feet of railroad tracks or highway pavement. If in the opinion of the City the tunnel installation work is being conducted in a manner detrimental to the overpassing roadway or to the safety of the traveling public, all operations of tunneling shall cease until the necessary corrections have been made. In the event that distress occurs to the roadway due to the tunneling operation, the contractor shall be required to submit a plan to repair the roadway. The plan must be acceptable to all governing agencies and the City.

- 16.8 Rip-Rap Material Requirements:** The contractor shall use either stone rip-rap or sand-cement rip-rap throughout the job. The rip-rap shall meet the following material requirements:

A. Stone Rip-Rap: Stone rip-rap shall be composed of sound, tough, durable stones resistant to the action of air and water, slabby or shaley pieces will not be acceptable. The stone's specific gravity shall be 2.0 or higher. The minimum weight of each individual stone shall be 50 pounds. The maximum allowable dimension for an individual stone shall be 24 inches. At least, 50% of the stones shall have a minimum dimension of 12 inches.

The contractor shall imbed the stone rip-rap neatly so as to form a compact layer at least 12 inches thick. The rip-rap shall be placed in such a way that the small stones are not segregated but evenly distributed. Chinking stones shall be placed in the crevices between the larger stones so that a dense, well graded mass is produced.

B: Sand-Cement Bag Rip-Rap: Sand-cement bag rip-rap shall be composed of cement sacks or burlap bags having a capacity of from one to two cubic feet. Bags previously used for sugar or chemicals will not be acceptable. Bags shall be filled with a mixture of one part Portland Cement to five parts sand.

17.0 CONCRETE PIERS

The contractor shall construct piers as shown on the approved drawings and in accordance with the following requirements.

- 17.1 Material:** Concrete shall have a compressive strength of no less than 3,000 PSI, with not less than 5.5 bags of cement per cubic yard and a slump between 2 ½ and four inches. For job-mixed concrete, the contractor shall submit the concrete mix design for approval by the City and the designing engineer. Ready-mixed concrete shall be mixed and transported in accordance with ASTM C 94. Reinforcing steel shall conform to the requirements of ASTM A 615, grade 40.
- 17.2 Bearing on Earth Foundations:** Where excavation reveals undisturbed earth subsurface, the pier shall be constructed with spread footing foundations.
- 17.3 Bearing of Rock Foundations:** Where excavation reveals level or benched rock having a Minimum safe bearing value of 20,000 PSF, piers shall be constructed with foundations

hearing directly on the rock. The contractor shall drill a minimum of four holes into the rock under each pier and grout dowels into place to anchor the pier to the rock. Hole and dowel sized shall be in accordance with the requirements of the following table:

ANCHORAGE REQUIREMENTS FOR PIERS ON ROCK

<u>Carrier Pipe size</u>	<u>Grout Hole Diam. (inches)</u>	<u>Grout Hole Depth (feet)</u>	<u>Reinforcing Bar Dowel Size</u>
8 - 24"	2.5	8	5
27 - 36"	4	8	6
42 - 48"	4	8	6
54"	4	8	6

The contractor shall grout holes from the bottom up using a grout pump. The contractor shall take extreme care to ensure that the entire hole is filled with grout prior to inserting the dowel.

17.4 Installation: The contractor shall employ experienced formwork carpenters to construct all forms. Formwork shall be built sufficiently strong to resist lateral movement and distortion during pouring and to protect the pier from caving in.

- A. Dewatering:** Before placing concrete, the contractor shall dewater the bottom of the hole and clean out all mud, loose earth, and extraneous matter.
- B. Pour Concrete:** The contractor shall place concrete as soon as possible after the forms have been approved. Excavation shall not be left open for prolonged periods of time. Excavation shall be protected from surface and ground water. The contractor shall not allow water to accumulate in the excavation or in the surrounding areas.
- C. Safety:** The contractor shall take all necessary precautions to protect the work and personnel on the site. Open holes shall be covered when work is not in progress. All surrounding excavations and embankments shall be examined for all possible hazards.
- D. Inspection:** The contractor shall select and, with the approval of the designing engineer and the City, employ a consulting soils and foundation engineer to perform the following:
 - 1. Inspect the material and evaluate its suitability.
 - 2. Inspect the pneumatically drilled grout holes where applicable.
 - 3. Check the dimensions and plumbness of the forms to ensure conformity with the drawings and specifications.
 - 4. Evaluate the material penetrated by the excavation with regards to its lateral stability and uplift resistance.
 - 5. Recommend remedial measures should insufficient later stability or uplift resistance exist.

18.0 TESTING AND ACCEPTANCE

The City reserves the right to continuously and/or periodically inspect construction methods to ensure compliance with these specifications. Unless other provisions have been specifically approved by the City, sewer lines and related facilities will be inspected and tested by the contractor with testing certified by the City before acceptance or continuity is established with the City's system. All lines must be clean and obstructions removed prior to requesting inspection and testing. When requested by the City, the contractor shall flush out lines and manholes before testing and inspection.

The contractor shall be required to test the sanitary sewer system for water tightness and, if PVC pipe is installed, a deflection test shall also be required. The City of Carrollton requires the sanitary sewer system to be televised as per section 21.0.

19.0 LOW PRESSURE AIR TEST PROCEDURES

The contractor shall perform a low pressure air test as specified in ASTM C 828. In the event the test fails the sewer and/or manholes shall be repaired in a manner satisfactory to the City and retested until the sewer is within the allowable limits.

All tests shall be conducted under the supervision of the City or its representative.

20.0 DEFLECTION TESTING OF GRAVITY SEWERS

All polyvinyl chloride gravity sewer lines shall be tested for excessive deflection. Testing for deflection shall be accomplished by the ability of the installed gravity sewer line to pass a go, no go mandrel test. A mandrel of not less than 5% allowable deflection shall be pulled through each section of sewer pipe at least 15 to 30 days after installation. All pipes not passing this mandrel shall be considered to have reached limit of its serviceability and shall be considered to have reached limit of its serviceability and shall be relaid or replaced by the City, at its discretion reserves the right to have the PVC line retested for deflection utilizing a mandrel allowing 7.5% deflection at one year from acceptance.

21.0 TELEVISION OF GRAVITY SEWERS

It is suggested that the entire sewer system be thoroughly cleaned by jetting or applicable methods prior to filming to avoid possible refilming costs. If conditions found indicate repairs are necessary, refilming may be required. However, the contractor may avoid refilming by performing all corrective work in the presence of a City Inspector upon the City's discretion. All sanitary sewer mains shall be filmed prior to initial approval and prior to the two(2) year maintenance period ending. All filming shall be done by persons and / or firms qualified in such work. The contractor shall perform all filming (video taping) in accordance with the following requirements:

- A.** All filming shall be on VHS format with speed as required to obtain optimal observation of any defects in the sewer line.

- B. Film shall be in good focus with a five-foot minimum depth of field with adequate but not excessive lighting. A footage counter on the film must be provided.
- C. The camera dragline shall not obstruct the view of the flow line of the sewer pipe.
- D. The film shall be submitted to the City in cassettes complete with a brief report as to the findings. The location and condition of service connections, water, debris, mud, etc., for each section between manholes and any observations of the filmer should be reported. A brief map or sketch on an 8 ½" x 11" sheet of paper of the improvements shall be supplied. The sketch shall indicate the following:
 - 1. The firm doing the filming
 - 2. Manhole number
 - 3. Distance between manholes
 - 4. Flow direction
 - 5. Street names
 - 6. North arrow
 - 7. Project name
 - 8. Date of filming

Each manhole on the film shall be marked with the following information:

- 1. Manhole number
- 2. Manhole to which the camera is traveling
- 3. Size and material of the pipe
- 4. Street name
- 5. Date of the filming

22.0 FORCE MAINS

The contractor shall furnish, install and remove all temporary bulkheads, flanges, or plugs required to perform tests, and furnish all equipment and labor to carry out the tests.

The contractor shall pressure test force mains at the pressure specified by the City measured at the lowest point. Tests shall be performed for a minimum of two hours at 250 PSI. Leakage shall not exceed the AWWA standards. If leaks are detected the contractor shall locate, repair and retest the force main. The repair methods must be approved by the City. If the results are not totally satisfactory, the City may require testing for a longer period of time.

23.0 LIFT STATION STANDARDS

- A. Drainage basin flow shall be calculated for the natural drainage basin area flowing into the proposed lift station. The flow shall be calculated based upon acre usage for the type zoning or anticipated densities and development type if there is evidence potentially greater wastewater flow being generated in excess of established zoning.

- B.** Lift Station influent line invert shall be set so that all upstream gravity flow into the lift station can be achieved. Influent pipe shall be sized at a minimum slope per 10 State Standard for basin flow with peak of 2.5 slope. This influent pipe shall be stubbed out to a point 20 feet from the pump station.
- C.** Lift station shall be sized based upon the anticipated upstream flow that will be realized in a seven-year period of basin development. The amount of development in a basin is judgmental and will be determined by the City.
- D.** Wet well shall be sized for a 2.5 peak flow condition. The allowable number of pump cycles per hour shall be determined by dividing the pump manufacturer recommended pump starts per hour by 1.3. Wet well shall have a plugged stub so that an additional wet well can be installed and interconnected when future flows dictate additional wet well storage. Stub out shall be at least as large as the influent pipe.
- E.** Pumps of 10 hp or greater shall have an electric hoisting system so that pumps can be removed and lifted into a flat bed truck, others may use a manual hoist. Pump station layout shall be such that a driveway will access the pump loading point. Pump station access drive can be either paved or gravel as directed. All pump stations driveway slopes shall not be greater than 10%. Drives shall be a minimum of 10 feet wide, eight-inch deep crusher run per Georgia DOT standards. Sub-base shall be compacted to 95% standard proctor per ASTM standards.
- F.** Pump station layout shall be configured so the station can be expanded to the ultimate size to pump the ultimate upstream flow. Initial and future land requirements including access for the pump station shall be obtained by the developer and donated to the City.
- G.** Force mains shall be sized for a minimum of two feet per second flow with pump station operating at minimum flow. All force mains shall be ductile iron pipe, polyethylene lined. Force mains shall have concrete thrust blocks. All fittings shall be mechanical joint. Air release valve location and sizes shall be located as required by the City
- H.** Pump motors shall be sized when possible for the ultimate basin flow. Pumps shall be sized when possible so that ultimate basin flow conditions can be achieved by increasing impeller size.
- I.** Surge valves shall be utilized when force mains surges are in excess of 150 PSI. Surge valves shall be mechanical and shall be field adjustable from 0 to 100% of the rated pressure capacity.
- J.** Either cushion swing check valve or hydraulic activated pump plug valves shall be used on the pump discharge as directed by the City. Pump check valves shall have an adjustable rapid closure in the event of power failure. Accumulator system shall be utilized to actuate plug check valve in the event of water pressure failure. Accumulator

shall operate all valves through two complete open and closing cycles.

- K. Dual electric feeds shall be provided from the utility grid when available. If dual feeders are not available, a generator receptacle shall be required with all motor control centers and shall be compatible with other alike stations. Building architecture shall be per the requirements of the City. For pump station with pumps in excess of 120 hp. motor starters, motor control center, and miscellaneous electric controls shall be housed in a building. Pump control panels for stations below 120 hp. shall be pedestal mount in a NEMA 4 enclosure. Pump stations shall sense wet well levels for stop-start pumps with floats.
- L. **Telemetry** - Lift Stations shall have telemetry installed to monitor power failure, high wet well pump failure and other sensing points as required by the City.
- M. Lift stations shall have a six-foot high security fence and security light.
- N. A potable water supply line and backflow preventer is required on all lift stations.
- O. A wet well vent pipe with bird screen is required on all lift stations.

24.0 PROTECTION AND RESTORATION OF WORK AREA

- 24.1 **General:** The contractor shall return all items and all areas disturbed, directly or indirectly, by work under these specifications to their original condition or better as quickly as possible after work is started.
- 24.2 **Restoration of Man-made Improvements:** The contractor shall protect or remove and replace, with the City's approval, all fences, piers, docks, walkways, mailboxes, pipelines, drain culverts, power and telephone lines and cables and other improvements that may be encountered in the work.
- 24.3 **Cultivated Growth:** The contractor shall not disturb cultivated trees or shrubberies unless approved by the City. Any such trees or shrubberies, which must be removed, shall be heeled in and replanted under the direction of an experienced nurseryman.
- 24.4 **Cutting of Trees:** The contractor shall not cut trees for the performance of the work except as absolutely necessary. Trees that shall remain in the vicinity of the work area shall be protected from damage from the equipment. The contractor shall remove excavated material stored over the root system of all trees within 30 days to allow proper natural watering of the root system. All damaged trees over three inches in diameter shall be repaired by an experienced nurseryman. All trees and brush that require removal shall be promptly and completely removed from the work area and disposed of by the contractor. No stumps, wood piles, or trash piles will be permitted on the work site.
- 24.5 **Grassing:** The contractor shall replant grass removed or damaged in residential areas using the same variety of grass when the first appropriate season occurs. Outside of developed areas, the contractor shall plant the entire area disturbed by the work in rye,

fescue, bermuda, or other suitable ground cover upon the completion of work in the area. In all areas, the contractor shall promptly re-establish successful stands of grass.

24.6 Erosion Control: Erosion sedimentation control shall be per Georgia Environmental Protection Division standards and per the requirements of applicable local government standards. The contractor shall plan excavation work to prevent erosion and washing of soil into adjacent streams. The contractor shall limit the amount of open excavation at any one time. Soil shall be placed in the proper place and all natural water routes shall be kept open.

24.7 Disposal of Rubbish: The contractor shall dispose of all materials cleaned and grubbed during the construction of the project in accordance with the applicable codes and rules of the appropriate regulatory agencies, county, state and federal.

25.0 EROSION AND SEDIMENTATION CONTROL DEVICES

Any site where land-disturbing activity occurs must be protected from erosion. Typically, the project engineer prepares an Erosion and Sedimentation Control Plan which must be submitted to the City for approval and permitting processes.

The City requires all current state manuals for Erosion and Sedimentation Control in Georgia and the City of Carrollton Soil and Erosion and Sedimentation Control Ordinance regulations be strictly adhered to in the field.

No land-disturbing activities shall be conducted in the buffer zones, unless required by the City. Discharge of stormwater runoff from disturbed property shall not exceed 50 Nephelometric Turbidity Units higher than the level of the receiving stream immediately upstream of the site.

Items required by the state and the City:

A. Silt Fence: Silt fence should be a commercially manufactured fabric approximately 30 inches in height supported vertically by wooden or metal stakes at ± three feet on center. Haybales may be utilized directly behind the silt fence to add an additional sedimentation barrier and support. Under certain applications, haybales may be used as a silt fence; however, for projects lasting over a six-month period a fabric barrier is required.

Silt sedimentation build-up behind silt fence must be removed periodically to maintain effective siltation control. A typical silt fence with haybales is shown in **Fig. 23**.

B. Detention and/or Sedimentation Pond: Any flow that is collected across a land disturbing site should be collected and routed through ditches, flumes or enclosed conduit to a detention and/or sedimentation pond. The pond must be designed to collect the flow and reduce its velocity to a level where the silt will be retained prior to its discharge off the site. The ponds are to be cleaned as sedimentation builds up in order to maintain a properly functioning system.

- C. **Filter Berms:** Filter berms at the exit from construction site may be required where land disturbing activities occur. These filter berms consist of a layer of #57 stone six feet to eight feet wide, 12 inches deep and be constructed completely across all egresses from the site. These filter berms must be cleaned regularly so they remain functional during the construction process. A typical filter berm is shown in **Fig. 24**.
- D. **Rip-Rapping:** Where directed by the City, rip-rapping will be required. A typical rip-rapping detail is shown in **Fig. 25**.
- E. **Rock Dams:** On open cut drainage ditches tributary to rivers, creeks, or reservoirs, rock dams must be placed at specified intervals. Rock dams should be constructed with #75 rip-rap stone and should cover the full width of the ditch from slope to slope. The stone should cover from the toe of slope to top of slope. A rock dam detail is shown in **Fig. 26**.
- F. **Grassing:** Grassing of disturbed areas should be done as soon as possible. The manual for erosion and sedimentation control list the types of grass used for the various times of the year and application rate of grass seeds and the fertilizer to be used on the various types of soil.

Additional items such as catch basins, pipes, storm drainage and paved ditches are other items that may be required by the City to minimize erosion on land disturbed sites.

Figures 18 – 22 Reserved for Future Use

